

## Not alone in solitude: a look into the surprising world of TOI-1130

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After the detection of numerous planetary systems outside of our own Solar System which tend to be extremely diverse and which show a wide range of evolutionary states, the focus is now shifting to a characterization of their formation and evolution, as well as to the architecture of planetary systems and planet habitability.

One of the astonishing discoveries in exoplanet research has been the detection of Jupiter-like planets (in size and mass) that orbit their host star within 10 days. These so-called hot Jupiters are found to be lonely objects that are rarely accompanied by smaller close-in companions. TOI-1130 is one of very these rare systems. It hosts two transiting planets: a hot Jupiter and an inner Neptune-sized planet that are near to the 2:1 period commensurability.

Planetary systems with transiting planets are markedly well-suited for a detailed characterization, since they allow the measurement of the planetary radius, which is essential to constrain the planet's evolution and migration history, as well as to characterize the internal structure of the planet. The second fundamental parameter for the characterization is the planetary mass, that together with the radius allows the bulk density of a planet to be estimated, thereby constraining its composition.

In order to find out the history and future evolution of exoplanet systems, a complete knowledge of all orbital and planetary parameters with a high accuracy is crucial. However, precise measurements of the planetary mass are difficult to obtain, in particular for small planets. If there are multiple planets in a system close to a period commensurability, as is the case for TOI-1130, the planetary masses can be determined using the gravitational interactions leading to measurable transit timing variations.

In this talk, I will present the results from a photodynamical joint modelling of high-precision radial velocities, TESS, and ground-based transit photometry. I will show that TOI-1130 is an excellent laboratory to test planet formation theories that I will investigate thanks to our precise planetary parameters.

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